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Growth of laser-induced damage during repetitive illumination of HfO_2-SiO_2 multilayer mirror and polarizer coatings*

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Hafnia-silica multilayer mirrors and polarizer coatings were prepared by e-beam evaporation. The optics were tested at use angle with a 3-ns-pulse at 1064 nm. The morphology of laser-induced damage was recorded after each shot to determine the types of damage that cause massive failure and lead to lower functional damage thresholds.

The results of the tests were summarized on damage stability maps showing damage size as a function of number of shots for different fluences. The maps indicate that the commonly observed damage morphologies (i.e. pits, scalds and outer layer delamination) have distinct growth behaviors and influence the value of the functional damage threshold differently. Pits can become unstable during repetitive illumination above a critical fluence. Scalds are formed during a single shot and do not grow. Finally, delaminates are highly unstable and have the potential for damaging polarizers massively. The origin of such damage morphology should be eliminated.

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